

# FLORISTIC AND ECOLOGICAL STUDIES ON LEGUMES FROM HILLY REGIONS OF PUNE AND SATARA DISTRICTS OF MAHARASHTRA STATE<sup>1</sup>

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## INTRODUCTION

Legume bearing plants form the third largest group among the angiosperms, containing about 748 genera and 19,700 species (Allen and Allen 1980). As far as India is concerned, a total number of 145 genera divided in 1083 species (Tiwari 1979) are reported from the subcontinent. In Maharashtra State there are about 88 genera and 380 species (Cooke 1903) of leguminous plants. This large group of economically important plants has been studied from various angles in all parts of our country. A study of the available literature on the flora of Western Maharashtra (Birdwood 1896, Bole and Almeida 1981, Cooke 1903, Hemadri 1971, Razi 1953, Santapau 1951, 1953, 1957; Tosh and Vartak 1985, Varadpande 1973, Vartak 1957, 1960, 1964; Vartak and Kumbhojkar 1984) showed that studies on agroecology and geographical distribution of legumes in this area are lacking. This study was, therefore, undertaken to collect data on this aspect of leguminous plants. The area of hilly regions in Pune and Satara districts in Maharashtra were selected for the study.

The paper presents data on floristic and ecological distribution of 242 species of legumes from the area under study. It is hoped that

this contribution would yield useful data for critical studies on legumes in different disciplines.

The data for the study have been collected under two projects namely "Studies on Nitrogen fixing legumes from Maharashtra State" and "Floristic studies on sacred groves along western ghats of Maharashtra State", being operated at our Institute with active participation of the Botany and Microbiology Departments. During routine botanical collection tours for the project work special efforts were made to collect leguminous plants with their root nodules, seeds, cuttings and seedlings for maintaining in M.A.C.S. nursery and preparation of herbarium specimens.

## TOPOGRAPHY OF THE STUDY AREA

The area covered in this work includes the hilly regions of Pune and Satara districts (17° 45'-19° 00' N. lat. and 73 ° 15'-74° 04' E. long.) spread over an area of approximately 15,000 sq. km. Historical forts like Sinhgad, Purandhar, Rajgad, Torna, Shivneri, Rohida, etc., and hill stations like Mahabaleshwar, Rareshwar, Khandala are included in the investigation of this work. The terrains around these locations have also been visited many times during botanical plant collection tours.

## *Climate*

The year is divided into three marked

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seasons: the cold season from November to February, the hot season from March to May and the rainy season from June to October. During the hot season the diurnal maximum temperature rises above 42.25°C, and temperatures as high as 46.25°C have been occasionally recorded. Rainfall pattern shows that the climate is "monsoon type", average about 150 cm.

#### MATERIALS AND METHODS

The plant materials collected were properly identified by using different floras and by referring to the herbaria of B.S.I. (Poona) and Blatter Herbarium, Bombay. They are preserved in M.A.C.S. herbarium after proper processing. The data collected have been presented on the basis of habitats.

#### GENERAL ACCOUNT OF LEGUMES

To study the floristics, ecology as well as the geographical distribution of leguminous species, the area under study can be divided into the western ghat range and the plains.

##### a) Legume flora of ghats and mountains :

Common legume constituents of the general vegetation of this area contain arboreal to herbaceous floral elements.

Tall, robust, and very beautiful trees we found in this area. Some of them are evergreen, but almost all others are deciduous. They are as follows:

*Butea monosperma* (Lamk.) Taub. (*Butea frondosa* Koen.); *Dalbergia lanceolaria* Linn.; *D. latifolia* Roxb.; *D. paniculata* Roxb.; *D. sissoo* Roxb.; *Erythrina suberosa* Roxb.; *E. stricta* Roxb.; *E. variegata* L. (*E. indica* Lamk.); *Ougeinia oojainensis* (Roxb.) Hochr. (*O. dalbergioides* Benth.); *Pongamia pinnata*

(L.) Pierre (*P. glabra* Vent.); *Pterocarpus marsupium* Roxb.; *Bauhinia purpurea* Linn.; *B. racemosa* Lamk.; *B. variegata* L.; *Caesalpinia sappan* L.; *Cassia fistula* L.; *Delonix elata* Gamble; *D. regia* Raf.; *Hardwickia binata* Roxb.; *Piliostigma malabaricum* (Roxb.) Benth. (*Bauhinia malabarica* Roxb.); *P. foveolatum* (Dalz.) Thoth. (*Bauhinia foveolata* Dalz.); *Saraca asoca* (Roxb.) de Wilde (*S. indica* L.).

#### THORNY AND SPINY SPECIES:

*Acacia catechu* Willd.; *A. chundra* (Rottler) Willd.; (*A. catechu* Willd. var. *sundra* (DC.) Prain); *A. intsia* Willd.; *A. leucophloea* (Roxb.) Willd.; *A. polycantha* Willd. (*A. suma* Buch.-Ham.); *A. tomentosa* Willd.

#### NON-THORNY SPECIES:

*Albizia amara* Boiv.; *A. chinensis* (Osb.) Merrill (*A. stipulata* Boiv.); *A. lucida* Benth.; *A. odoratissima* Benth.; *A. procera* Benth.

#### Common undershrubs, shrubs and scandent shrubs:

*Atylosia lineata* Wt. & Arn.; *A. sericea* Benth.; *Crotalaria leptostachya* Benth.; *C. retusa* L.; *Dalbergia sympathetica* Nimmo.; *Desmodium gangeticum* DC.; *D. heterocarpon* (L.) DC. (*D. polycarpum* DC.); *D. triangulare* (Retz.) Merrill (*D. cephalotes* Wall. var. *congestum* Prain); *D. velutinum* (Willd.) DC. (*D. latifolium* DC.); *Flemingia strobilifera* R. Br.; *Indigofera cassioides* Rottl. ex DC. (*I. pulchella* Roxb.); *I. tinctoria* L.; *I. trita* L.; *I. trita* L. var. *maffei* Ali (*I. oreophila* Sant. & Panthki); *I. trifoliata* L.; *Mundulea sericea* (Willd.); *A. cheval* (*M. suberosa* (DC.) Benth.); *Tephrosia coccinea* Wall.; *T. pentaphylla* (Roxb.) G. Don. (*T. senticosa* Wt.); *T. pulcherrima* (Baker) Gamble; *T. tinctoria* Pers.; *Sesbania bispinosa* (Jacq.) W. F. Wight (*S. aculeata* Poir.); *Caesalpinia decapetala*

(Roth.) Alst. (*C. sepiaria* Roxb.); *Cassia auriculata* L.; *C. sophera* L.; *C. surattensis* Burm. var. *surattensis* Chatt. (*C. glauca* Lamk.); *Acacia farnesiana* Willd.; *A. latronum* Willd.; *A. pennata* Willd.; *A. sinuata* (Lour.) Merrill (*A. concinna* DC.); *A. torta* (Roxb.) Crab. (*A. caesia* Willd.), and *Mimosa hamata* Willd.

Among the tall and robust climbers and climbers commonly noticed are:

*Abrus precatorius* L.; *Butea superba* Roxb.; *Dalbergia volubilis* Roxb.; *Derris scandens* Benth.; *Caesalpinia nuga* Ait.; *Mezoneuron cucullatum* (Roxb.) Wt. & Arn.; *Wagatea spicata* Dalz.

COMMON TWINERS:

*Atylosia platycarpa* Benth.; *A. scarabaeoides* (L.) Benth.; *Canavalia gladiata* (Jacq.) DC. (*C. ensiformis* DC.); *C. stocksii* Dalz.; *Dolichos bracteatus* Baker; *Dumasia villosa* DC.; *Mucuna monosperma* DC.; *M. pruriens* DC.; *Neonotonia wightii* Lackey (*Glycine wightii* Verd.); *Nogra dalzellii* (Baker) Merr. (*Grona dalzellii* Bak.); *Paracalyx scariosa* (Roxb.) Ali (*Cylista scariosa* Roxb.); *Pueraria tuberosa* DC.; *Rhynchosia hirta* (Andr.) Meikle & Verd. (*R. cyanosperma* Benth.); *R. minima* (L.) DC. var. *laxiflora* Baker; *Teramnus labialis* Spreng; *Vigna catjang* Walp.; *V. unguiculata* Walp.; *V. vexillata* A. Rich. var. *sepiaria* Babu; *V. vexillata* A. Rich. var. *stocksii* Benth.; *V. vexillata* A. Rich. var. *vexillata*.

HERBACEOUS LEGUMES:

*Alysicarpus beddomei* Schindl. (*Desmodium rotundifolium* Baker); *A. belgaumensis* Wt.; *A. bupleurifolius* (L.) DC.; *A. longifolius* Wt. & Arn.; *A. monilifer* (L.) DC.; *A. procumbens* (Roxb.) Schindl. (*A. hamosus* Edgew); *A. pubescens* Law.; *A. racemosus* Benth. (*A. belgaumensis* var. *racemosus* Baker); *A. rugosus* DC.; *A. rugosus* DC. var. *heyneanus* Baker; *A. rugosus* DC. var. *ludens*

Baker; *A. rugosus* DC. var. *styracifolius* Baker; *A. tetragonolobus* Edgew.; *A. vaginalis* (L.) DC.; *A. vaginalis* DC. var. *nummularifolia* Baker; *A. vasvadae* Hemadri; *Clitoria biflora* Dalz.; *Crotalaria albida* Heyne; *C. bifaria* L. f.; *C. calycina* Schrank; *C. filipes* Benth.; *C. filipes* Benth. var. *tricophora* Cooke; *C. hebecarpa* (DC.) Rudd. (*Goniogyna hirta* DC.); *C. juncea* L.; *C. linifolia* L.; *C. medicaginea* Lamk.; *C. medicaginea* Lamk. var. *neglecta* Baker; *C. mysorensis* Roth; *C. nana* Burm.; *C. orixensis* Willd.; *C. pallida* Ait. (*C. striata* DC.); *C. prostrata* Rottl. (*C. prostrata* Roxb.); *C. stocksii* Benth.; *C. triquetra* Dalz.; *C. vestita* Baker; *Desmodium alysicarpoides* Van Meeuwen (*D. parviflorum* (Dalz.) Baker); *D. dichotomum* (Willd.) DC., (*D. diffusum* DC.); *D. gangeticum* DC. var. *maculatum* Baker *D. reniforme* DC.; *Dolichos falcatus* Klein ex Willd.; *Flemingia gracilis* (Mukherjee) Ali (*Maughania gracilis* Mukherjee); *F. nilgheriensis* (Baker) Wt.; *Indigofera cordifolia* Heyne, *I. dalzellii* T. Cooke; *I. deccanensis* Sanjappa; *I. glandulosa* Roxb.; *I. glandulosa* Roxb. var. *sykesi* Baker; *I. linifolia* (L.f.) Retz.; *I. linifolia* Retz. var. *campbelli* Wt.; *I. linnaei* Ali (*I. enneaphylla* L.); *I. nummularifolia* (L.) Livera ex Alst. (*I. echinata* Willd.); *I. santapau* Sanjappa; *I. spicata* Forsk. (*I. endecaphylla* N. Jacq., "hendecaphylla"); *I. trita* L. var. *purandharensis* Sanjappa; *Pseudarthria viscida* (L.) Wt. & Arn.; *Smithia agharkarii* Hemadri; *S. bigemina* Dalz.; *S. blanda* var. *racemosa* Baker; *S. conferta* Sm.; *S. hirsuta* Dalz.; *S. purpurea* DC.; *S. pycnantha* Benth.; *S. salsuginea* Hance; *S. sensitiva* Ait.; *S. sensitiva* Ait. var. *fulva* Cooke; *S. setulosa* Dalz.; *Taverniera cuneifolia* Arn. (*T. nummularifolia* Baker); *Tephrosia purpurea* Pers.; *T. strigosa* (Dalz.) Sant. & Mahesh. (*T. tenuis* Wall.); *T. tinctoria* Pers.; *T. uniflora* Pers. (*T. pauciflora* Grah. ex Baker); *Trigonella occulata*

Delile; *Vigna aconitifolia* (Jacq.) Marechal (*Phaseolus aconitifolius* Jacq.); *V. angularis* (Willd.) Ohwi & Ohashi (*Phaseolus angularis* (Willd.) Wt.); *V. dalzelliana* (O. Ktze.) Verdc. (*Phaseolus dalzellii* Cooke); *V. khandalensis* (Sant.) Rag. & Wad. (*Phaseolus khandalensis* Sant.); *V. radiata* var. *sublobata* (Roxb.) Verd. (*Phaseolus sublobatus* Roxb.); *V. radiata* Wilczek (*Phaseolus radiatus* L.); *V. trilobata* (L.) Verdc. (*Phaseolus trilobatus* Ait.); *Zornia gibbosa* Span. (*Z. diphylla* Pers.); *Cassia absus* L.; *C. mimosoides* L.; *C. obtusifolia* L.; *C. pumila* Lamk.; *C. tora* L.

#### b) Legume flora of the plains :

1. General vegetation of scattered trees of *Erythrina suberosa* Roxb.; *E. variegata* L. var. *alba*; *Acacia nilotica* (L.) Del. subsp. *indica* (Benth.) Brenan var. *cupressiformis* (Stewart) Vaj. & Kamble; *A. nilotica* (L.) Del. subsp. *vediana* (Cooke) Vajravelu & Kamble; *A. eburnea* Willd.; *Dichrostachys cinerea* Wt. & Arn.; *Prosopis cineraria* (L.) Druce; have established themselves in waste and drier areas.

2. Seasonal vegetation: Annual and perennial herbs which put forth shoots annually from underground parts at different seasons of the year.

#### COMMON LEGUMES OF CULTIVATED LANDS:

*Aeschynomene indica* L.; *Alysicarpus tetragonolobus* Edgew.; *Indigofera cordifolia* Heyne; *I. glandulosa* Roxb.; *Melilotus indica* All.; *Psoralea corylifolia* Linn.; *Sesbania bispinosa* (Jacq.) Wt. (*S. aculeata* Poir.); *Sesbania sesban* (L.) Merr. (*S. aegyptica* Poir.); *Vigna trilobata* (L.) Verdc. (*Phaseolus trilobatus* Ait.); *Cassia pumila* Lamk.

#### PROMINENT COMMUNITIES OF LEGUMES DURING RAINY SEASON IN PASTURE LANDS AND LAWNS:

*Alysicarpus bupleurifolius* (L.) DC.; *A. procumbens* (Roxb.) Schindl. (*A. hamosus* Edgew.); *A. tetragonolobus* Edgew.; *A. vaginalis* (L.) DC.; *Crotalaria filipes* Benth.; *Crota-*

*laria nana* Burm.; *C. orixensis* Willd.; *Desmodium dichotomum* (Willd.) DC. (*D. diffusum* DC.); *D. triflorum* (L.) DC.; *Geissaspis cristata* Wt. & Arn.; *G. tenella* Benth.; *Indigofera cordifolia* Heyne; *I. glandulosa* Roxb.; *I. hirsuta* L.; *Smithia bigemina* Dalz.; *S. hirsuta* Dalz.; *S. purpurea* DC.; *S. pycnantha* Benth.; *Stylosanthes fruticosa* (Retz.) Alst. (*S. mucronata* Willd.); *Tephrosia uniflora* Pers.; *Lathyrus aphaca* L.; *Medicago lupina* L.; *Vicia hirsuta* Koch.; *Zornia gibbosa* Span. (*Z. diphylla* Pers.); *Cassia pumila* Lamk.; and *Mimosa pudica* L. These communities survive well where moisture is available.

#### LEGUMES OF DRIED ROCKY SOIL:

*Alysicarpus monilifer* DC.; *A. pubescens* Law.; *A. vasvadae* Hemadri; *Indigofera hochstetteri* Baker (*I. anabaptista* Steud. ex Baker); *I. linifolia* Retz.; *I. linnaei* Ali; *I. spicata* Forsk.; *Mundulea sericea* (Willd.) A. Cheval; *Tephrosia purpurea* Pers.; *Cassia auriculata* L.

#### HEDGE LEGUMES:

Some legumes grow along the hedges, i.e. along the bunds of the cultivated fields and house boundaries. These are:

*Canavalia gladiata* DC.; *Clitoria ternatea* Linn.; *Rhynchosia minima* DC.; *Paracalyx scariosa* Ali; *Caesalpinia crista* L.; *C. decapetala* Alston.

#### SALINE LAND LEGUMES:

Due to excess irrigation the salinity of the soil increases. A few legumes grow well in saline soil, like:

*Sesbania bispinosa* (Jacq.) Wt.; *Acacia nilotica* (L.) Willd.; *Prosopis juliflora* (Sw.) DC.

#### LEGUME FLORA OF WATER-LOGGED SOIL:

Few species grow in water-logged area as aeration of soil is very poor. These are:

*Aeschynomene indica* L.; *Smithia purpurea* DC.; *S. sensitiva* Ait.; *Cassia pumila* Lamk.

WASTE LAND LEGUMES:

Waste lands are areas which are not cultivated. In such sites for example roadsides exotics predominate, These are:

*Desmodium scorpiurus* (Swartz) Desvaux; *Rhynchosia rothii* Benth. (*R. sericea* Span.); *Tephrosia purpurea* Pers.; *Cassia hirsuta* L.; *C. occidentalis* L.; *C. tora* L.; *C. uniflora* Mill.

LEGUME FLORA OF SACRED GROVES:

Sacred groves are undisturbed forests kept inviolate in the name of Gods and Goddesses. Occurrence of giant climbers like *Entada pursaetha* DC. (*E. scandens* Benth.); *Dalbergia volubilis* Roxb.; *Mucuna monosperma* DC.; *Mezoneuron cucullatum* Wt. & Arn.; *Wagatea spicata* Dalz. was noticed in such places. Especially *Entada pursaetha* DC. is found only inside sacred groves. Other legumes are:

*Acacia pennata* (L.) Willd.; *A. sinuata* (Lour.) Merr. (*A. concinna* DC.); *Albizia amara* (Roxb.) Boiv.; *A. chinensis* (Osb.) Merr.; *Dalbergia sympathetica* Nimmo; *Pongamia pinnata* (L.) Pierre.

PLANTATION AND NORMAL FORESTS:

Because of excessive biotic interference, particularly due to deforestation the plains are almost denuded and devoid of natural forests. The rehabilitatory steps taken by the forest department and public have resulted in extensive plantation in the remnants of the natural forests as well as in waste places. Farm forestry constitutes one of the most conspicuous aspects of the vegetation and is an integral part of the forests in the area. Some legumes figure prominently in the afforestation programme of the area. Important species among these are:

*Dalbergia melanoxylon* Guill & Pers.; *D. sissoo* Roxb.; *D. lanceolaris* L.; *Pongamia pinnata* (L.) Pierre; *Cassia siamea* Lamk.;

*Acacia auriculiformis* A. Cunn.; *Albizia lebeck* (L.) Willd.; *Leucaena leucocephala* (Lamk.) de Wit. (*L. glauca* Benth.). These species are naturalized to the climatic conditions of Pune and Satara districts and show better growth performance. They are, therefore, recommended for afforestation programmes in the area.

ORNAMENTAL LEGUMES:

The species planted in public gardens and Botanical gardens as ornamental plants are: *Millettia atropurpurea* Benth.; *M. ovalifolia* Kurz.; *Phaseolus vulgaris* Linn.; *Sesbania grandiflora* (L.) Pers.; *Sophora tomentosa* L.; *Trifolium alexandrinum* Delile.

Many species occurring *Acrocarpus fraxinifolius* W. & A.; *Bauhinia acuminata* L.; *B. galpini* Brown; *B. hookeri* F. Muell.; *B. purpurea* L.; *B. variegata* L.; *Brownea grandiceps* Jacq.; *Caesalpinia pulcherrima* Swartz; *C. coriaria* Willd.; *C. ferrea* Mart.; *Cassia fistula* L.; *C. grandis* L.; *C. nodosa* Buch.-Ham.; *C. renigera* Wall.; *C. roxburghii* DC.; *C. spectabilis* DC.; *C. surattensis* Burm. var. *surattensis* Chatt.; *Delonix regia* Raf.; *Saraca asoca* (Roxb.) de Wilde.; *Adenantha pavonina* L.; *Calliandra brevipes* Benth.; *C. haematocephala* Hask.

ROADSIDE LEGUMES:

A few species of legumes are planted along roadside for shade and shelter.

*Dalbergia melanoxylon* Guill & Pers.; *Pongamia pinnata* (L.) Pierre; *Cassia siamea* Lamk.; *Peltophorum pterocarpum* (DC.) Baker ex Heyne; *Tamarindus indica* L.; *Acacia nilotica* (L.) Willd.; *Parkia biglandulosa* Wt. & Arn.; *Samanea saman* (Jacq.) Merr.

LEGUMES USED AS GREEN MANURE:

Some species of legumes are used as green manure. They are *Crotalaria juncea* L.; *Sesbania sesban* (L.) Merr.

CULTIVATED LEGUMES:

Some species are cultivated more widely in this area. These are:

*Arachis hypogea* L.; *Cajanus cajan* (L.) Millsp.; *Cyamopsis tetragonoloba* Taub. (*C. psoralicoides* (Lamk.) DC.); *Lablab purpureus* (L.) Sweet. (*Dolichos lablab* L.); *Macrotyloma uniflorum*. (Lam.) Verd. (*Dolichos uniflorus* L.); *Phaseolus lunulatus* L.; *Pisum sativum* L.; *Psophocarpus tetragonolobus* DC.; *Trigonella foenum-graecum* L.; *Vigna mungo* (L.) Hopper; *V. radiata* (L.) Wilczsek.

INTRODUCED LEGUMES:

In all 41 species are introduced. Some of these are now naturalised in this area. These are:

*Arachis hypogea* L.; *Cajanus cajan* (L.) Millsp.; *Gliciridia sepium* (Jacq.) Kunth.; *Millettia atropurpurea* Benth.; *M. ovalifolia* Kurz.; *Macroptilium atropurpureum* (Benth.) Urb.; *Phaseolus vulgaris* Linn.; *Acrocarpus fraxinifolius* W. & A.; *Bauhinia acuminata* L.; *B. galpinii* Brown; *B. hookeri* Muell.; *B. monandra* Kurz.; *B. tomentosa* L.; *Brownea grandiceps* Jacq.; *Caesalpinia coriaria* Willd.; *C. ferrea* Mart.; *C. pulcherrima* Sw.; *Cassia alata* L.; *C. angustifolia* Vahl; *C. didymbotria* Fresen; *C. grandis* L.; *C. javanica* L.; *C. nodosa* Buch.-Ham.; *C. renigera* Wall.; *C. roxburghii* DC.; *C. siamea* Lamk.; *C. spectabilis* DC.; *Ceratonia siliqua* L.; *Colvillea racemosa* Boj.; *Delonix regia* Raf.; *Haematoxylon campechianum* L.; *Parkinsonia aculeata* L.; *Peltophorum pterocarpum* (DC.) Baker ex Heyne; *Acacia auriculiformis* A. Cunn.; *Calliandra brevipes* Benth.; *C. haematocephala* Hask.; *Desmathus virgatus* Willd.; *Leucaena leucocephala* Hassk.; *Parkia biglandulosa* Wt. &

Arn.; *Pithecellobium dulce* (Roxb.) Benth.; *Samanea saman* (Jacq.) Merr.

RARELY OCCURRING SPECIES:

*Geissaspis tenella* Benth.; *Rhynchosia hirta* (Andr.) Meikle & Verdc., and *Smithia pycnantha* Benth. This paper mainly describes the ecological distribution pattern of the legumes and their adaptation to a particular habitat in addition to the taxonomy of relevant taxa. Data on this aspect of legumes were not available for this area.

The analysis of the genera and species covered is presented in the following table:

Family name	No. genera	No. species	No. varieties
Fabaceae	54	155	19
Caesalpinaceae	17	53	1
Mimosaceae	13	34	2
Total:	84	242	22

DISCUSSION

In all 242 species belonging to 84 genera of the 3 families of legumes have been collected and recorded. Legumes are the most important component of the natural vegetation of local floras. Economically legumes are sources of food, fodder, timber, dyes, gums, resins, oil, medicine, green manure, etc. Growing in every soil type and climatic conditions, they show great variety in habit, e.g. trees, shrubs, scandent shrubs, herbs, climbers, twiners, etc. Some of them are excellent soil binders and are often planted for checking soil erosion. The use of leguminous plants in soil improvement projects has been given top priority by Agriculture and Forest Departments. Legumes enrich the soil either by fixing the atmospheric nitrogen through their root nodules and liberating it as these decay, or by ploughing in

the whole plant as green manure. It is always a beneficial practice to take a crop of pulses after cereals.

During the present study *Macroptilium atropurpureum* (Benth.) Urb. has been recorded as new to Maharashtra State and Goa. It is an introduced species from U.S.A. *Millettia atropurpurea* Benth. has been also reported as new to this state.

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